THE ART of BLANCHARD SURFACE GRINDING

BLANCHARD

The Art

OF

SURFACE GRINDING

With The Blanchard Grinder

BLANCHARD

THIRD EDITION

A HANDBOOK FOR THE BLANCHARD OPERATOR

THIS BOOKLET will assist you in obtaining the superior quality and quantity performance inherent in your Blanchard Grinders. It will pay you to read it—be guided by its suggestions—and have it handy for reference.

THE BLANCHARD MACHINE COMPANY
64 State Street
Cambridge 39, Massachusetts, U.S.A.

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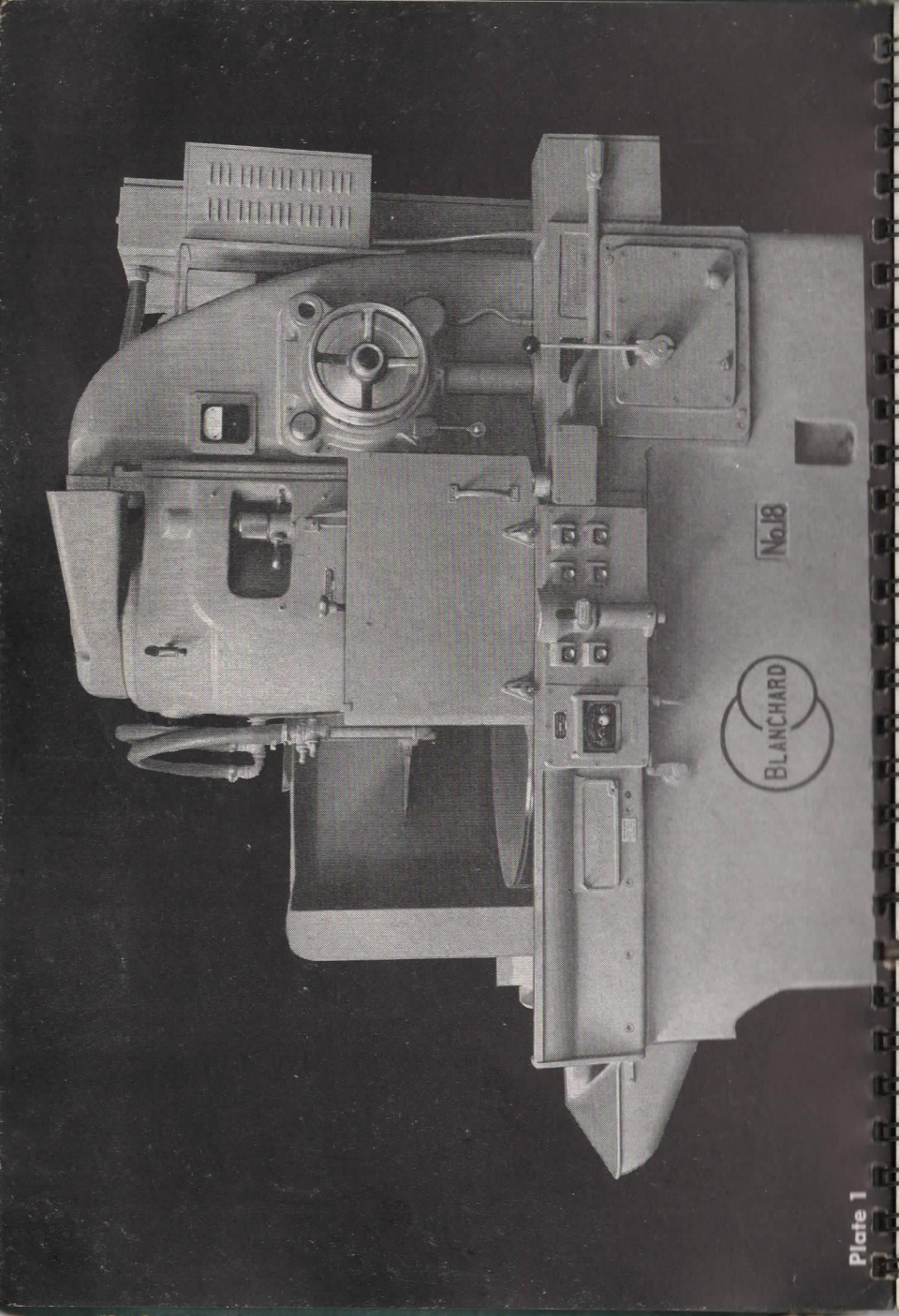


Plate 1

I

BLANCHARD GRINDING

Surface grinding is the term used to indicate the grinding of flat surfaces. The Blanchard Grinder is generally recognized as the quality machine tool for surface grinding where maximum production, finish and accuracy are prerequisites. The acceptance of the Blanchard Grinder as the leader in its field is so general that specifications often call for a surface to be "Blanchard ground."

Continuous development of the Grinders and Wheels has extended the field of Blanchard Grinding to new materials. closer limits, and finer finishes. The materials ground include the usual ferrous metals; many non-ferrous metals such as aluminum, magnesium, copper, brass, and bronze; also glass, carbon, plastics, and minerals such as quartz, agate, and sapphire. Extremely close limits of size, flatness that is best measured with an optical flat, and finishes measuring only a few micro-inches are all obtainable by Blanchard Grinding. Blanchard jobs range from jewel watch bearings to pieces having a swing of seven feet.

The typical Blanchard Grinding Wheel is a hollow cylinder—solid, sectored, or divided into segments. The end or base of the hollow cylinder is the grinding surface, which results in a broad area of contact with the material being ground. Because of the broad contact area of the Blanchard Wheel, the kind of abrasive, the grain size or grit, the grade, and the bond used are all important, and a variation in any one of these may result in a marked difference in the grinding action of the wheel.

The secret to successful Blanchard Grinding is (1) the use of the correct wheel for the job; (2) the correct operating procedure. For this reason a large part of this booklet is devoted to these subjects.

II

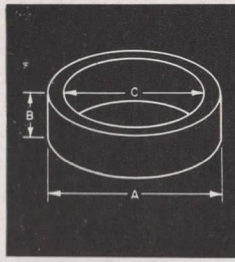
GRINDING WHEELS FOR BLANCHARD GRINDING

Why Blanchard Makes Wheels

In the early days of Blanchard Grinding—back in the middle twenties—this Company had its own grinding wheel problems. The wheels we were able to purchase for Blanchard Grinders were often not uniform in grade, the available selection was limited, and delivery dates often extended into the distant future. Because of these wheel difficulties, Blanchard Grinders frequently were restricted to a work performance which was considerably lower than the maximum possible. In order to remedy this condition, and to assure our Blanchard Grinder customers the best performance resulting from an always available source of proper wheels, this Company decided to make its own grinding wheels. The policy then—and still adhered to—was to specialize only on wheels for Blanchard Grinders. Our research and development work is continuous. Our objective is to produce wheels and segments of highest quality. The raw materials used are the best obtainable. Our manufacturing methods and inspection procedures assure a precision product.

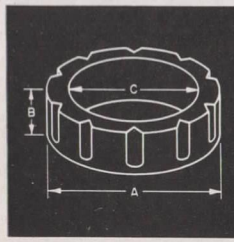
There is no better wheel for a Blanchard than a Blanchard Wheel

BLANCHARD WHEEL SPECIFICATIONS



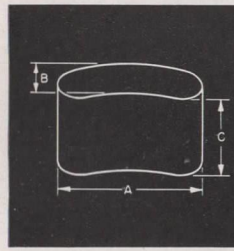
CYLINDER WHEELS

BLANCHARD GRINDER	Size in Inches			Wheel Area Sq. In.
	A	B	C	
No. 10	10	4	8	28.3
No. 11	11	5	9	31.4
No. 16 (Belt Drive)	16	5	13	68.3
No. 16 and No. 18	18	5	15	77.7
No. 18 with Extended Head	20	5	16½	100.5
No. 16A and No. 16A2	18	5	12	141.3
No. 16A and No. 16A2	18	5	10	176.0



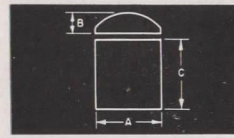
SECTORED WHEELS *

BLANCHARD GRINDER	Size in Inches			Wheel Area Sq. In.
	A	B	C	
No. 10	10	4	7½	30.0
No. 16 (Belt Drive)	16	5	12¾	65.0
No. 16 and No. 18	18	5	14	89.0
No. 16A and No. 16A2	18	5	10	154.0



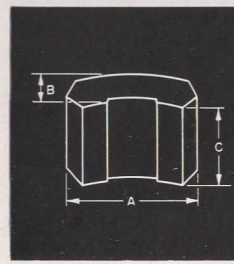
BLANCHARD CHUCK SEGMENTS

BLANCHARD GRINDER	Set No.	Dia. of Chuck Inches	No. Per Set	Size in Inches			Wheel Area Sq. In.
				A	B	C	
No. 11	BL11	11	4	6 1/4	1 1/4	5	31.0
No. 16 and No. 18	BL18	18	6	7 1/16	1 3/4	6	70.1
No. 18	BL20	20	8	5 11/16	2	6	83.1
No. 27 — 48	BL27	27	8	7 3/4	2 1/2	7	140.8
No. 32 — 48	BL32	32	8	9 5/16	2 11/16	7	192.8
No. 36 — 60	BL36	36	10	8 3/4	3	8	232.0
No. 42 — 72 — 84	BL42	42	10	10 1/8	3	8	282.5



CORTLAND CHUCK SEGMENTS

USED ON BLANCHARD GRINDER	Set No.	Dia. of Chuck Inches	No. Per Set	Size in Inches			Wheel Area Sq. In.
				A	B	C	
No. 16 and No. 18	CD18	18	4	11 1/4	2 1/4	5	73.6
No. 18	CD22	22	5	11 1/4	2 1/4	5	92.0



NORTON CHUCK SEGMENTS

BLANCHARD GRINDER	Set No.	Dia. of Chuck Inches	No. Per Set	Size in Inches			Wheel Area Sq. In.
				A	B	C	
No. 16 and No. 18	NO18	18	8	5	1½	6	54.0
No. 18	NO20	20	9	5	1½	6	60.75
No. 16 and No. 18	NO18A	18	8	5 5/16	2 1/4	6	91.3
No. 22A-3, 4, 5	NO22A	22	10	5 5/16	2 1/4	6	114.1

* Available in silicate bond only.

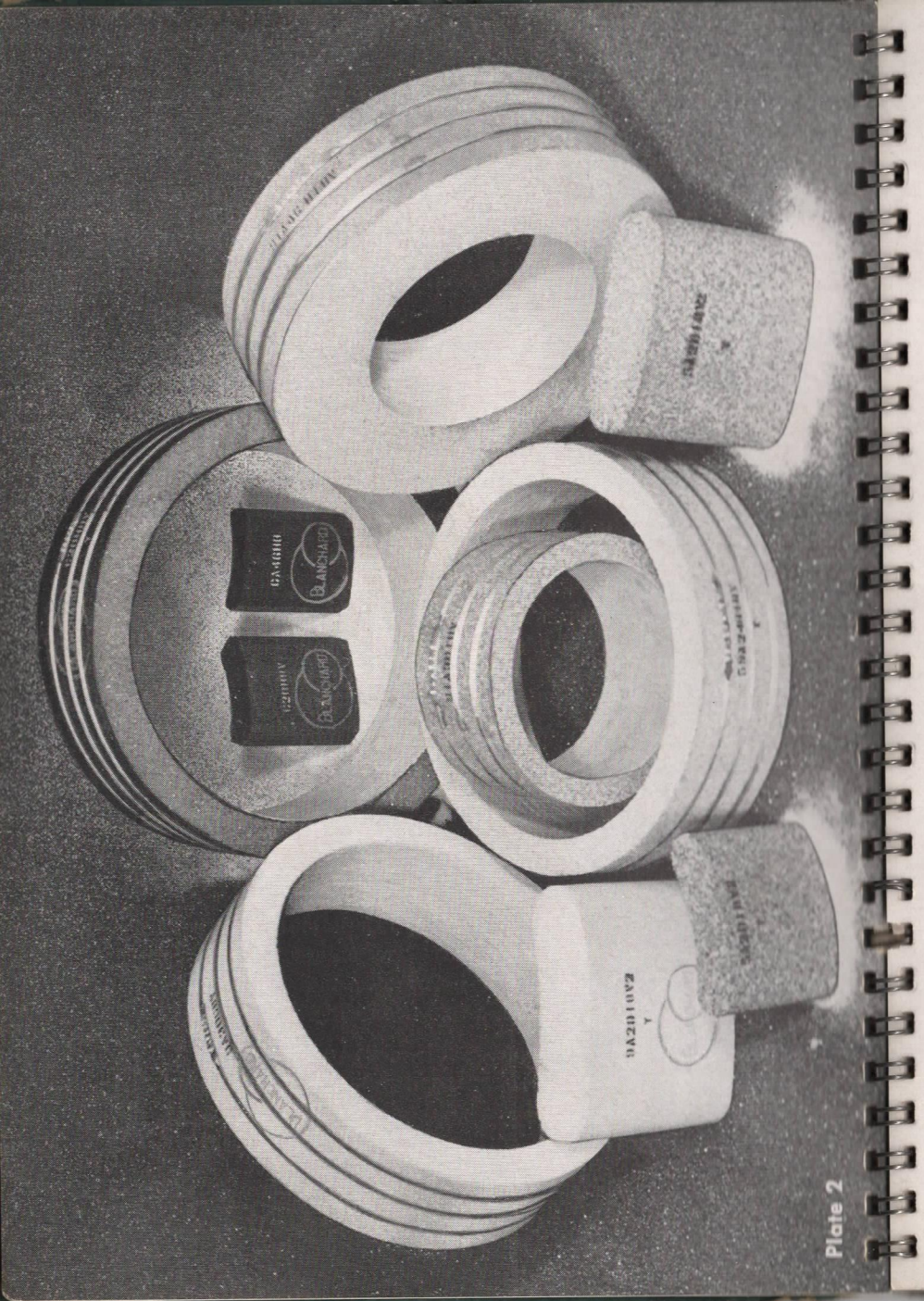


Plate 2

Types of Wheels

There are several types of wheels for Blanchard Grinding. Those most commonly used are the Cylinder, the Segment, and the Sectored Wheels. The advantages and disadvantages of each are detailed below:

Cylinder Wheel. The Cylinder Wheel is the most popular and generally the most satisfactory type wheel for Blanchard Grinding. The proper Cylinder Wheel will stay sharp with little or no dressing. Wear will be just sufficient to maintain this sharpness and no more. The grain size will be so selected as to provide clearance for chips, depending upon the nature of the material and the total area of the surface being ground, and as to produce the desired finish. The contact with the work is continuous with the maximum area of abrasive surface in contact. The Cylinder Wheel should always be selected for fine finishes and where extreme flatness accuracy is required. Due to the broken contact surface, the Segment, and to a lesser extent the Sectored Wheel, will often cause scratches on a fine finish and a rounding off of the edges of the surfaces being ground. It takes less time for a trained operator to change a Cylinder Wheel than to install a new set of Segments; and, as against resetting the Segments, there is only a wire band, in the case of the Cylinder Wheel, to be cut and removed.

Segment Wheel. The Segment Wheel is popular with many operators. It consists of several abrasive segments securely clamped into a segment chuck. There are several types of these chucks, and each type requires a special shape segment. Blanchard manufactures segment chucks for Segment Wheels of the following diameters: 18″, 32″, 36″, and 42″. The number of segments per set for each of these chucks, respectively, is: 6, 8, 10, and 10. Safety, balance, and ease of clamping are necessary requirements for a satisfactory segment wheel, and these are provided in Blanchard Segment Wheels. Segments

are set out to compensate for wear but should never project more than 2″. The segments are gripped so securely that only one to two inches of the segment in the chuck is required for holding the last 2″. Backing blocks or ring are used to prevent any possibility of a segment cocking. The spaces between the segments facilitate the clearance of chips, which makes the segment wheel particularly suitable for grinding broad surfaces and rough castings. It is not suitable for grinding small pieces or narrow surfaces especially where a fine finish and flatness accuracy are required. The interrupted grinding surface has a tendency to catch and tip small pieces and throw them from the chuck.

Sectored Wheel. The Sectored Wheel is essentially a cylinder wheel of increased rim thickness with V-shaped notches molded into the outer surface. The effect of these V-shaped notches is to give approximately the same number of linear inches of abrasive on any circumference. Thus each abrasive grain does the same amount of work. The Sectored Wheel is cool-cutting, free from vibration, and uniform in grade. As in the case of the Segment Wheel, it is particularly suitable for grinding broad surfaces. Sectored Wheels are available in the following dimensions: 10″ x 4″ x 7½″, 16″ x 5″ x 12¾″, 18″ x 5″ x 14″ and 18″ x 5″ x 10″.

Bonds

The bond is the material used to cement together the abrasive grains and hold the individual grains in place while they are in contact with the material being ground. The bond must be strong enough to hold the grains firmly while they are acting as miniature cutting tools; it must also be soft enough so that when a grain has become dull the added resistance will break the grain or tear it loose, thus exposing fresh sharp cutting points. Because of the large area of contact with the work, the

importance of the bond in wheels for Blanchard Grinding is apparent. In general a relatively soft wheel is required for Blanchard Grinding. Of the various bonds used in the manufacture of grinding wheels, the resinoid silicate and vitrified bonds are most generally used in making wheels for Blanchard Grinding.

Abrasives

The abrasive grain material in Blanchard Wheels is either silicon carbide or aluminum oxide. Three grain types of aluminum oxide are used: the tough, or regular, semi-friable, and the white, highly refined friable grain. Each of these abrasives has its advantages for certain kinds of work. Silicon carbide generally gives best results on materials of low tensile strength such as cast iron, chilled iron, brass, aluminum, bronze, fiber, ceramics, and similar materials.

Regular aluminum oxide is brown in color. It is a tough, strong grain, suitable for grinding tough, relatively soft metals, such as soft low carbon steels and malleable iron.

The semi-friable aluminum oxide is more highly refined than the regular, but less so than the white. It is intermediate in toughness between the two. It too is used for grinding steel in the soft state. In combination with the white it is particularly effective in meeting some grinding requirements.

The white highly refined aluminum oxide is the most useful abrasive for the general run of Blanchard grinding. It is used principally for hardened or soft high carbon steels, high speed steel, and hard alloys, and is the best general purpose abrasive for all materials.

The number used for designating the grain size or grit, corresponds to the number of meshes per linear inch in the sizing screen. The coarser grits will generally give a satisfactory finish for most purposes, and as they cut faster it is usually best to use them—except when grinding materials such as chilled iron and hardened steel, where the grain depth of cut is limited and grits

larger than 24 are not recommended. In fact, wheel wear generally becomes excessive if grits coarser than 20 are used. The proper grit is generally dictated by the nature of the material and the area of the surface presented to the wheel: the narrower the surface, the finer the grit; and the broader the surface, the coarser the grit. Similarly, the harder the material, the finer the grit; the softer and more ductile the material, the coarser the grit. The action of an abrasive grain in grinding is similar to that of a cutting tool in machining a surface.

Grade

The term "grade" as applied to grinding wheels is the measure of the hardness of the wheel. The harder the grade, the more securely the grains are held and the greater the force required to break them out of the wheel.

In selecting the proper wheel for a particular job, the following should be considered: the nature of the material, the dimensions of the pieces and total area being ground, the amount of the material to be removed, and the finish and accuracy desired. The effect of material is expressed best in tensile strength—the greater the tensile strength, the softer the grade required. Narrow pieces will take a harder wheel than broad surfaces. That is, the broader the surface, the softer the grade. For rapid cutting, a wheel must keep itself sharp by wear. Therefore for rapid stock removal select a relatively soft grade.

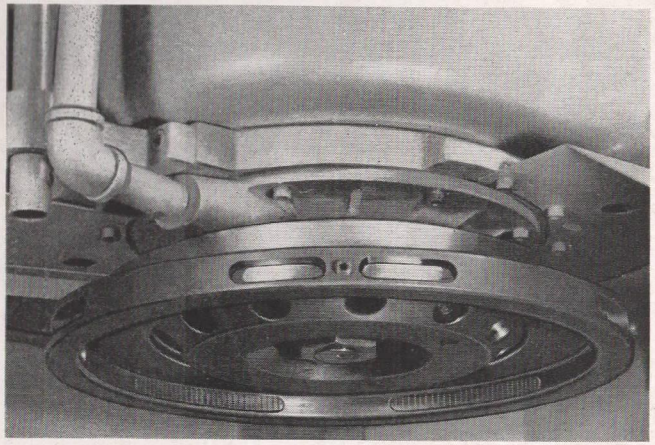
Fine Finishes

Grits from 60 to 220 are used for fine finishes. The harder the material and broader the surface, the softer the grade required. Some examples of the wheels used for fine finishes are given herein. To obtain best results proper operational procedure must be followed. This is covered in Section III, "Grinder Operation."

The No. 11 Blanchard, grinding hardened steel, has produced finishes as fine as ¾ of a microinch rms, measured by the Profilometer; and pieces as large as 5″ in diameter have checked within .00001″ for flatness. Expensive lapping operations can often be eliminated by fine finishing on a Blanchard. It should be noted that good finishes, from 15 to 20 microinches, can be obtained *with relatively coarse wheels* if the proper operating procedure is followed.

Blanchard Cylinder Wheel Holders

We recommend the Blanchard Cylinder Wheel Holder for mounting cylinder wheels on Blanchard Grinders. When ordering a wheel holder give the serial number of the Blanchard on which it will be used, and the dimensions of the abrasive



wheel to be mounted in it. The principal advantage of the wheel holder is the speed with which wheels can be changed and the consequent saving of grinder time.

A Cylinder Wheel Holder is similar to a wheel ring but somewhat larger in diameter. The wheel is held by spring clamps actuated by set screws. The instructions which are sent with each wheel holder should be carefully followed.

For use in a wheel holder the wheel must have a strip of Vellumoid (a gasket material) around the top. The letter "K" after the dimensions, e.g. 18″ x 5″ x 15″K, indicates that the wheel is for use in a wheel holder. We make no charge for these strips.

Handling and Storage of Wheels

The cylinder wheel because of its relatively thin section is more fragile than most other types of grinding wheels. Care must, therefore, be taken in shipping, packing and unpacking, handling, and storage, or breakage may be expected. Wheels should not be dropped or rolled along the floor. Racks should be provided for storage of wheels. It is usually more convenient to rack them vertically, that is with the axes horizontal. Proper labeling will facilitate finding a desired wheel if several different grits and grades are carried in stock. Wheels should not be stored in the open or in damp cellars. They must be kept dry and extreme temperature changes avoided.

Grinding Costs

It should be pointed out that wheel costs are only part of total grinding costs. Labor, overhead, and any burden charged to grinder and not included in overhead will usually be the greater part of grinding costs. The rate of stock removal is a primary factor in these costs, and it will often be found that a soft wheel, which may appear to wear away too fast, will grind the work at the lowest overall grinding cost.

The following equation may be used to obtain the wheel cost per piece ground:

$$c = \frac{Cd}{DN} \text{ where}$$

c = Wheel cost per piece, dollars
C = Cost of wheel, dollars
d = Wheel wear, inches of depth, in grinding N pieces
D = Usable wheel depth, inches
N = Number of pieces ground

A convenient method of obtaining the amount of stock removed is to subtract the weight of the pieces after grinding from their weight before grinding, thus obtaining the weight of the stock removed. If this weight is divided by the weight per cubic inch of the metal, we obtain the number of cubic inches of stock removed. While the weight of metal varies according to its composition, the following weights per cubic inch will usually give sufficiently accurate results:

Cast Iron	= 0.256 lbs.
Steel	= 0.283 lbs.
Aluminum	= 0.098 lbs.
Brass	= 0.305 lbs.
Bronze	= 0.316 lbs.

To obtain the amount of abrasive in cubic inches required to remove á given amount of stock, determine the wheel wear by subtracting the total depth of cut or thickness of material removed from the total down feed. Then divide this wheel wear by the wheel wear per cubic inch of abrasive for the particular wheels used.

THE BLANCHARD METHOD OF MARKING WHEELS

91A 24 H 8 V 2

ABRASIVE		GRAIN SIZE			GRADE			STRUCTURE			BOND	MFR'S SYMBOL
BASIC	MIXTURE	COARSE	MEDIUM	FINE	SOFT	MEDIUM	HARD	CLOSE	MEDIUM	OPEN		
A	51A	14	30	80	D	H	K	4	7	10	V	1 2
5A	91A	16	36	100	E	I	L	5	8	11	B	W X
9A	59A	20	46	150	F	J	M	6	9	12	S	Y Z
C	CA	24	60	220	G		N	SOMETIMES OMITTED				SOMETIMES OMITTED

EXPLANATION

ABRASIVE — The letter "A" indicates an Aluminum Oxide Abrasive; A, the regular or tough; 5A, semifriable; 9A, highly refined, friable. The letter "C" indicates Silicon Carbide Abrasive. 91A is a mixture of A and 9A, CA of C and A etc.

GRAIN SIZE — The number used for designating the grain size or grit, corresponds to the number of meshes per linear inch in the sizing screen.

STRUCTURE — Measure of grain spacing or density. Omitted in Blanchard Silicate wheels.

GRADE — The letters indicate relative bond strength. Two letters indicate a half grade. For example, HI is midway between H and I grades.

BOND — V indicates Vitrified; B, Resinoid; and S, Silicate Bond.

MANUFACTURER'S SYMBOL — The numbers 1 or 2 indicate that the actual grade is on the soft or hard side respectively of grade shown. The letters W, X, Y, and Z indicate variations from standard bonds.

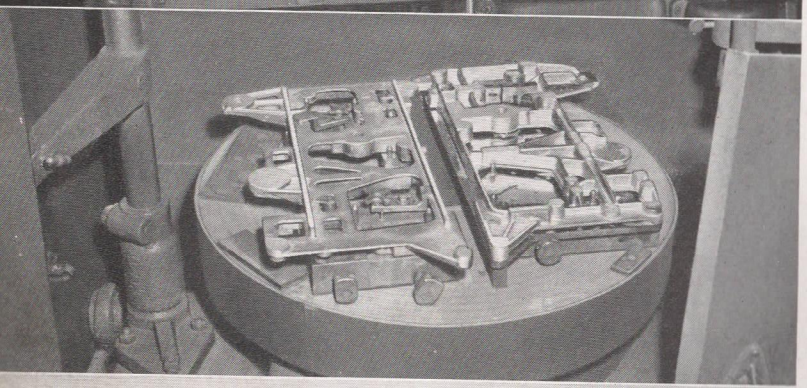
BLANCHARD WHEEL RECOMMENDATIONS

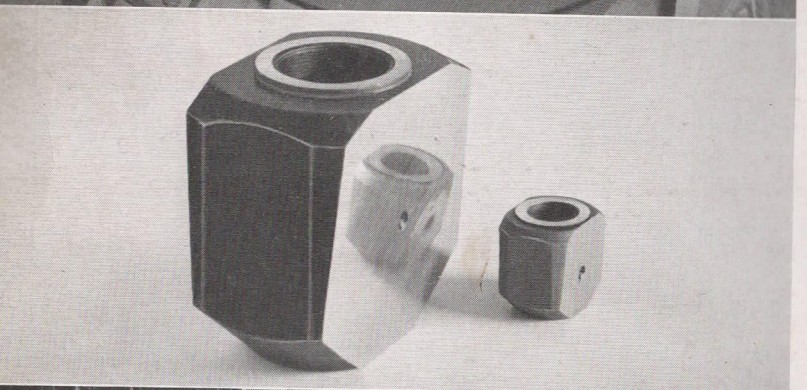
***18" X 5" X 15" WHEELS ON NO. 18 BLANCHARD GRINDERS — FERROUS METALS**

We manufacture only wheels for Blanchard grinding, in all grits and grades and in Vitrified Silicate and Resinoid Bonds. For other materials ask for Blanchard Service.		AREA OR WIDTH OF SURFACE		
		NARROW	MEDIUM	BROAD
MATERIAL	FINISH RMS			
Cast Iron	90	C 30 I 8 V	C 20 H 8 V	C 20 GH 8 V
	90	C 30 J S	C 20 I S	C 20 H S
	15	C 80 H B	C 80 G B	C 80 FG B
Stainless Steel	60	CA 46 HI B	CA 46 H B	CA 46 GH B
	10	CA 100 I B	CA 100 HI B	CA 100 H B
1020 Mach. Steel & Boiler Plate	75	A24 I 8 V	91A 24 HI 8 V	5A 20 H 8 V
	75	A24 I S	5A 24 H S	5A 24 GH S
	16	C 150 J B	C 150 I B	C 150 H B
High Carbon Steel, Annealed	50	91 A 30 I 8 V	91A 24 H 8 V	9A 24 GH 8 V
	50	5A 36 I S	9A 24 H S	9A 24 GH S
	8	9A 100 I B	9A 100 HI B	9A 100 H B
Tool Steel Hardened 55R[c]	25	9A 46 H 8 V	9A 30 GH 8 V	9A 20 G 8 V
	25	9A 46 H S	9A 30 G S	9A 24 G S
	6	9A 100 H B	9A 100 G B	9A 100 G B
High Speed Steel, Hardened 62R[c]	25	59A 60 GH 8 V	9A 46 G 8 V	9A 30 FG 8 V
	25	9A 46 G S	9A 46 G S	9A 30 F S
	6	9A 100 H B	9A 100 G B	9A 100 FG B
General Purpose Wheels: 9A 24 H 8 V — 91A 30 H 8 V — 9A 24 H S				

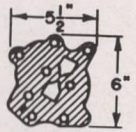
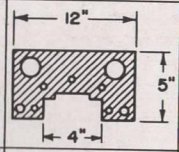
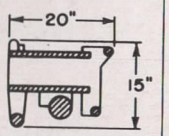
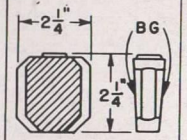
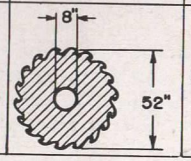
* For 11" x 5" x 9" wheels and all segments use one half to a full grade harder. For 20" x 5" x 16½" wheels use one half grade softer. On No. 16 Blanchards use one grade softer.

To cut fast and/or accurately a wheel must wear away, thus exposing new sharp grains. USE A SOFT WHEEL — USE ENOUGH FEED TO MAKE WHEEL CUT FAST — PROVIDE ENOUGH POWER TO CARRY THIS FEED. If wheel fails to cut freely, glazes or burns the work, the remedy is one or more of the following: (1) Dress wheel; (2) Use more feed and power; (3) Use softer or coarser wheel; (4) Reduce the area being ground.





WHEEL SELECTION EXAMPLES

	PIECES MATERIAL	SURFACE	STOCK REMOVAL FINISH* LIMITS	CHUCK PIECES ON CHUCK TOTAL AREA	TABLE SPEED FEED	WHEEL
Plate 3	FUEL PUMP GEAR SPACER Cast Iron		1/16" A Side Commercial Fine ±.002"	No. 18-36" 34 96 sq. in.	18 RPM .020" 33 RPM .004"	C30JS C100HB
	HYDRAULIC PUMP Valve Plate Hardened Steel		R.005" F.0015" A Side Fine ±.0002" Flat within .00002"	No. 11-16" 12 60 sq. in.	R24 RPM F41 RPM R.009 F.004	9A46GS 9A120GHB
Plate 4	TOP PLATE SUB PRESS Die Steel Plate 3		.010" A Side Good Parallel	No. 11-16" 1 45 sq. in.	24 RPM .012"	9A24HS
	FRAME Aluminum Plate 4		.070" A Side Commercial ±.002"	No. 18-30" 2 30 sq. in.	33 RPM .076"	C20LS
Plate 5	VALVE WEDGES Hard Stainless Steel Plate 5		.010" Fine Flat .00005"	No. 18-Fix 18 72 sq. in.	28 RPM .004"	9A120GB
Plate 6	SAW Saw Steel Plate 6		.010" A Side Commercial ±.002"	No. 27-60" 1 2826 sq. in.	8 RPM .008"	9A24FS

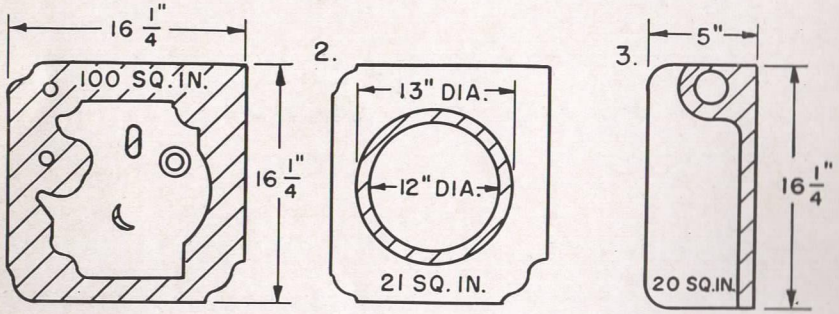
*Finish classifications in micro-inches: Commercial, 25-50 micro-inches; Good, 12-25 micro-inches; Fine, 2 to 12 micro-inches.

MATERIAL: CAST IRON.

WHEEL: C20GH8V — 20" x 5" x 16½"K. Mounted in Blanchard Cylinder Wheel Holder.

BLANCHARD GRINDER: No. 18-C, 36" Table, 35 HP, Extended Head & Column.

THE JOB: Gear Boxes. Blanchard Grind 3 sides, Removing ⅛" to ¼" per side. 35 pieces. Limits ± .002".



HOW LOADED: One at a time, center of chuck.

TABLE SPEED: 1st side 18 R.P.M., 2nd side 33 R.P.M., 3rd side 18 R.P.M.

FEED: 1st side .048", 2nd side .060", 3rd side .048" per minute.

DRESSED WHEEL: None Required.

STOCK REMOVED PER PIECE, CU. IN.: #1 — 15.65, #2 — 9.10, #3 — 4.88 Total — 29.63 cubic inches.

GRINDING TIME PER PIECE: #1 — 5, #2 — 4.33, #3 — 2.5 Total — 11.83 Minutes.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 2.5.

WHEEL WEAR PER PIECE, CU. IN.: 3.57.

ABRASIVE COST PER PIECE: $.29 (average of 35 pieces).

FLOOR-TO-FLOOR TIME PER PIECE: 15.00 Minutes.

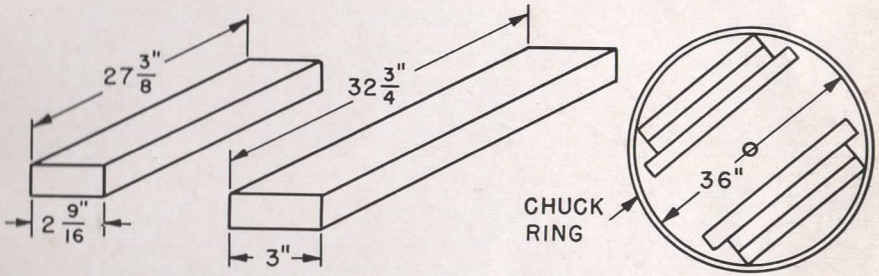
REMARKS: Total time for 35 pieces, 9 hours. Abrasive used, 125 cu. in. This compares with 16.12 hours and 400 cu. in. of abrasive for wheel previously used. An illustration of the importance of wheel selection. Also an example of using high feeds to get production.

MATERIAL: Cast Iron.

WHEEL: C20H8V — 20" x 5" x 16½"K. — Mounted in Cylinder Wheel Holder.

BLANCHARD GRINDER: No. 18-C, 36" Table, 35 HP, Extended Head & Column.

THE JOB: Cast Iron Spacer Bars. Rough Size Approximately 1-3/16". Finish to .900" ± .005". No Finish Requirement. Two Sizes of Bars Ground. (See Below.)



HOW LOADED: Four Small Bars and Two Large Bars to a Load. (See Sketch.)

TABLE SPEED: 18 R.P.M.

FEED: .044"/Minute.

DRESSED WHEEL: None Required.

STOCK REMOVED PER PIECE, CU. IN.: First Side — 9.03, Second Side — 7.32, Total — 16.35

GRINDING TIME PER PIECE: First Side — 1 Min. 20 Sec., Second Side — 45 Sec., Total — 2 Min. 5 Sec.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: First Side — 6.80, Second Side — 9.55. Average — 8.18

WHEEL WEAR PER PIECE, CU. IN.: 2.2.

ABRASIVE COST PER PIECE: $.182.

FLOOR-TO-FLOOR TIME PER PIECE: 2 Minutes 36 Seconds.

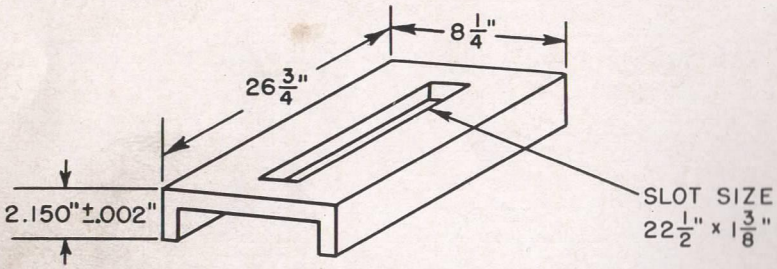
REMARKS: The above results are a good example of rapid stock removal taking a piece from the "as cast" state to finished size in two operations. The high rate of feed used sacrifices wheel wear for increased savings in actual floor-to-floor time per piece.

MATERIAL: Aluminum Casting.

WHEEL: C3018V 20" x 5" x 16½"K. Blanchard Cylinder Wheel.

BLANCHARD GRINDER: No. 18-C, 36" Table, 35 HP, Extended Head & Column.

THE JOB: Blanchard Grind Top Face of Aluminum Casting. One Operation, Flat & Parallel ± .002".



HOW LOADED: 1 Piece at a time. Held on Center of Chuck with Appropriate Blocking.

TABLE SPEED: 18 R.P.M.

FEED: .020"/Minute.

DRESSED WHEEL: None.

STOCK REMOVED PER PIECE, CU. IN.: 31.30.

GRINDING TIME PER PIECE: 9 Minutes plus 1 Minute Run Out.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 3.475.

WHEEL WEAR PER PIECE, CU. IN.: 1.5.

ABRASIVE COST PER PIECE: .11.

FLOOR-TO-FLOOR TIME PER PIECE: 12 Minutes.

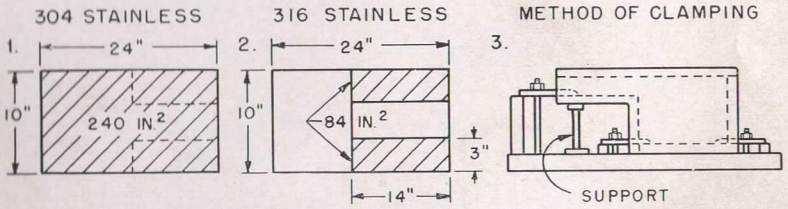
REMARKS: The legs of the casting, which are against the chuck, have been ground in a previous operation. Size at the start of the above operation is 2-5/16". This job is being run on automatic cycling of the machine with no dressing or additional work required by the grinder operator.

MATERIAL: Stainless Steel — 300 Series.

WHEEL: CA46GB 20" x 5" x 16½"K. Mounted in Blanchard Cylinder Wheel Holder.

BLANCHARD GRINDER: No. 18, 35 HP, 42" Chuck.

THE JOB: Fabricated Stainless Steel — Part of Assembly. Blanchard Grind 2 sides. Flat & Parallel ±.001". 20-30 R.M.S.



HOW LOADED: Clamped to Fixture (see sketch), one at a time.

TABLE SPEED: 1st Operation — 12 R.P.M., 2nd — 12 R.P.M.

FEED: 1st Operation — .012"/Minute, 2nd — .012"/Minute.

DRESSED WHEEL: 1 Dress at Finish, each side.

STOCK REMOVED PER PIECE, CU. IN.: 1st Operation — 2.160, 2nd — 1.840. Total — 4.00.

GRINDING TIME PER PIECE: 8½ Minutes (Total).

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: .461.

WHEEL WEAR PER PIECE, CU. IN.: 6.90.

ABRASIVE COST PER PIECE: $.569.

FLOOR-TO-FLOOR TIME PER PIECE: 18½ Minutes.

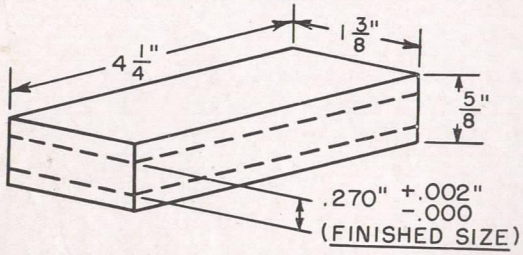
REMARKS: Head of grinder was tipped to grind on back side of wheel only. It was found that power consumption of greater than 100% full load on meter was necessary to grind at all. Average power consumption for above work load 125%. The CA46GB wheel was 100% more efficient than the next best wheel used. Wheel wear on the stainless steel is high but must be expected. Generally the cost for this type of work runs about five times that of ordinary soft steel.

MATERIAL: #416 Stainless Steel.

WHEEL: 9A46IJ8V — 20" x 5" x 16½"K. Blanchard Cylinder Wheel.

BLANCHARD GRINDER: No. 18-C, 36" Table, 35 HP, Extended Head & Column.

THE JOB: #416 Stainless Steel Blocks. Part of an Assembly. Blanchard Grind to .270" $^{+.002"}_{-.000"}$ from ⅝" stock. Remove equal Stock from each side. Finish better than 63 R.M.S. Two Operations.



HOW LOADED: 129 Pieces, Two Rows, Held Magnetically.

TABLE SPEED: 18 R.P.M.

FEED: .024"/Minute.

DRESSED WHEEL: None.

STOCK REMOVED PER PIECE, CU. IN.: 2.08.

GRINDING TIME PER PIECE: 24.5 Seconds.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 5.08.

WHEEL WEAR PER PIECE, CU. IN.: .71.

ABRASIVE COST PER PIECE: $.0523.

FLOOR-TO-FLOOR TIME PER PIECE: 55.8 Seconds.

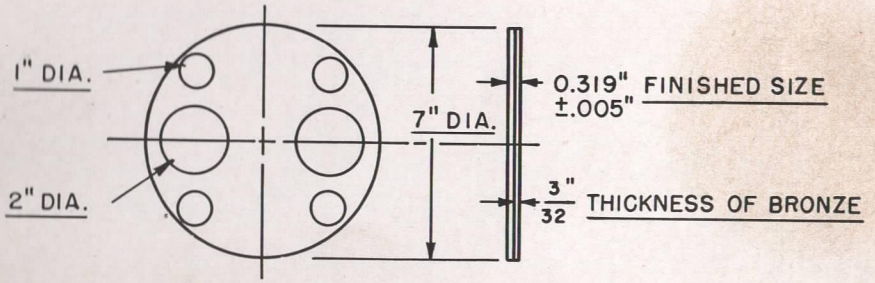
REMARKS: Average power consumption on the above pieces ran 135% to 140% full load. This job is an illustration of the use of highly refined aluminum oxide on 400 series stainless steel. Proper selection of wheel grade and bond type for this particular grade of stainless has given a free cutting wheel with stock removal comparable to low carbon steel. Another example of efficient Blanchard grinding through the use of Blanchard engineered wheels.

MATERIAL: 1020 Machine Steel.

WHEEL: 5A2018V — 18" x 5" x 15"K. Blanchard Cylinder Wheel.

BLANCHARD GRINDER: Std. No. 18, 36" Table, 35 HP.

THE JOB: Steel Valve Plate with Bronze Backing. Blanchard Grind Steel Side. Flat within .003". Finish 75 R.M.S.



HOW LOADED: 18 Pieces on Chuck. Two Rows, held in Fixture Plate.

TABLE SPEED: 18 R.P.M.

FEED: .020"/Minute.

DRESSED WHEEL: One Dressing before Finish.

STOCK REMOVED PER PIECE, CU. IN.: .723.

GRINDING TIME PER PIECE: 10 Seconds (including run-out).

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 4-1/3.

WHEEL WEAR PER PIECE, CU. IN.: .108.

ABRASIVE COST PER PIECE: $.01.

FLOOR-TO-FLOOR TIME PER PIECE: 1 Minute, 6 Seconds.

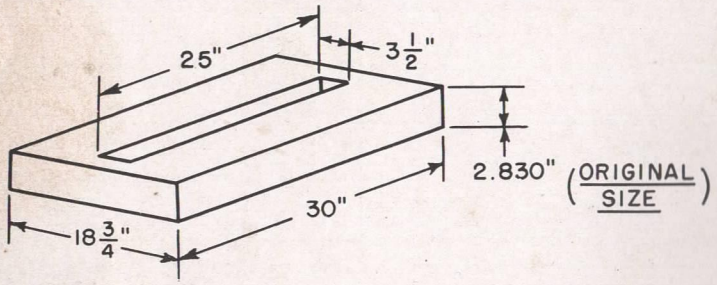
REMARKS: The floor-to-floor time includes grinding to clean up bronze side of the plate to give a bearing for grinding the steel side. This operation is done very rapidly with a plunge cut using the same wheel with negligible wear. 135% full load power consumption average while grinding steel side.

MATERIAL: 1020 Machine Steel.

WHEEL: 91A24GH8V — 20" x 5" x 16½"K. Blanchard Cylinder Wheel.

BLANCHARD GRINDER: No. 18, 36" Table, 35 HP, Extended Head & Column.

THE JOB: Blanchard Grind Two Sides to 2.500 ± .010" from Original Size of 2.830". Commercial Finish.



HOW LOADED: One at a Time.

TABLE SPEED: 12 R.P.M.

FEED: .040"/Minute.

DRESSED WHEEL: Once at Finish.

STOCK REMOVED PER PIECE, CU. IN.: 157.

GRINDING TIME PER PIECE: 20 Minutes.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 7.85.

WHEEL WEAR PER PIECE, CU. IN.: 47.

ABRASIVE COST PER PIECE: $3.50.

FLOOR-TO-FLOOR TIME PER PIECE: 32 Minutes (includes disc sanding by operator).

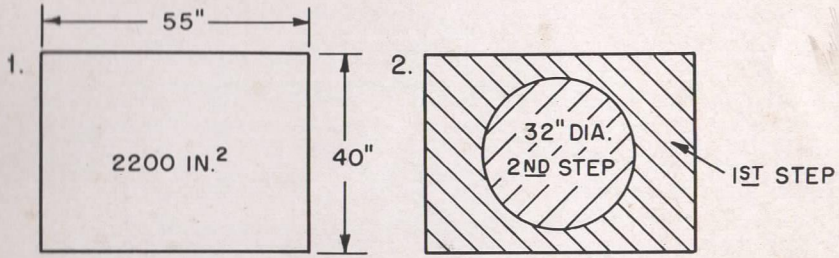
REMARKS: An example of using a high rate of feed to obtain rapid stock removal and the minimum grinding time per piece. A lower rate of feed would give greater wheel life and lower wheel cost per piece but the over-all grinding cost would be more.

MATERIAL: 1020 Machine Steel.

WHEEL: Blanchard 5A2018V — BL42" Segments.

BLANCHARD GRINDER: No. 42-72, 75 HP, 84" Swing.

THE JOB: Large Steel Plate, 3½" thick, Part of a Press Set Up. Blanchard Grind Two Sides. Flat & Parallel ±.002". No Finish Requirement. Clean Up.



HOW LOADED: Held Magnetically, Center of Chuck. Step Ground.

TABLE SPEED: 4.8 R.P.M.

FEED: .024"/Minute.

DRESSED WHEEL: None.

STOCK REMOVED PER PIECE, CU. IN.: 220 (average).

GRINDING TIME PER PIECE: 16 Minutes.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 13.75.

WHEEL WEAR PER PIECE, CU. IN.: 39.56.

ABRASIVE COST PER PIECE: $2.10.

FLOOR-TO-FLOOR TIME PER PIECE: 40 Minutes.

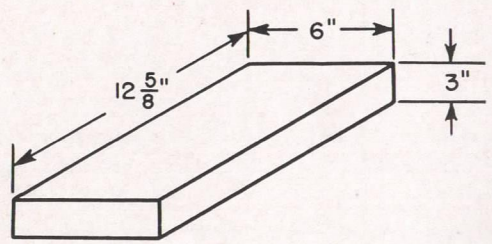
REMARKS: The high rate of stock removal on the above job was due to both careful wheel selection and the use of step grinding methods. The work was step ground in two operations. (See Drawing 2.) On larger plates than above, step grinding in three operations is common. Average power consumption for above work 125% full load.

MATERIAL: S.A.E. 3310 Steel.

WHEEL: 5A2018V — BL42-42". Blanchard Segments.

BLANCHARD GRINDER: No. 42-72, 100 HP, 84" Swing.

THE JOB: Blanchard Grind Two Sides. Remove ¼" Stock. Hold Flat & Parallel ±.002" Commercial Finish.



HOW LOADED: 32 Pieces on Chuck, Held Magnetically.

TABLE SPEED: 3 R.P.M.

FEED: .012" Minute.

DRESSED WHEEL: Once, Just Before Finish.

STOCK REMOVED PER PIECE, CU. IN.: 18.97.

GRINDING TIME PER PIECE: 2.5 Minutes.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 7.58.

WHEEL WEAR PER PIECE, CU. IN.: 6.28.

ABRASIVE COST PER PIECE: $.30.

FLOOR-TO-FLOOR TIME PER PIECE: 3.76 Minutes.

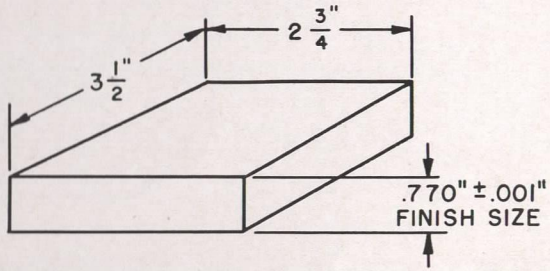
REMARKS: An example of grinding a strong, tough steel on the 42-72 Blanchard. You will note a considerable saving over other methods of finishing the two surfaces.

MATERIAL: Rex-AA High Speed Steel, Annealed.

WHEEL: 91A3018V — 11" x 5" x 9"K. Mounted in Cylinder Wheel Holder.

BLANCHARD GRINDER: No. 11, 16" Chuck, 15 HP.

THE JOB: Blanchard Grind Two Sides. Flat & Parallel ±.001". Commercial Finish Required.



HOW LOADED: 9 Pieces on Chuck, Held Magnetically.

TABLE SPEED: 24 R.P.M.

FEED: .016"/Minute.

DRESSED WHEEL: None.

STOCK REMOVED PER PIECE, CU. IN.: 3.42 (Average).

GRINDING TIME PER PIECE: 2¾ Minutes.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 1.24.

WHEEL WEAR PER PIECE, CU. IN.: 1.24.

ABRASIVE COST PER PIECE: $.119.

FLOOR-TO-FLOOR TIME PER PIECE: 3.17 Minutes.

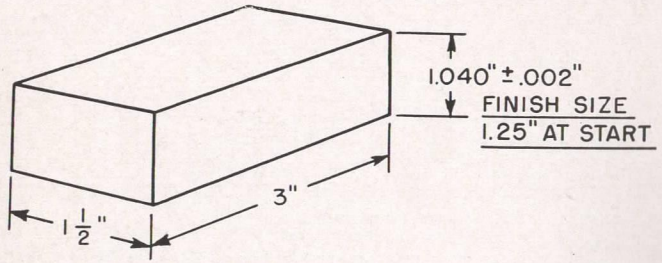
REMARKS: The pieces being ground on this job are 1⅛" thick at the start with finish size of .770" ±.001" required. This is an example of a wheel for general grinding being used effectively on soft high speed steel. This same wheel would operate effectively on soft machine steel or boiler plate (broad surfaces), Meehanite (narrow to medium surfaces) and cast iron (narrow surfaces).

MATERIAL: High Chrome, High Carbon Tool Steel, Annealed.

WHEEL: 9A30HI8V — 11" x 5" x 9"K. Blanchard Cylinder Wheel.

BLANCHARD GRINDER: Standard No. 11, 16" Chuck, 15 HP.

THE JOB: Grind 2 sides. Flat & Parallel ±.002". Commercial Finish.



HOW LOADED: 24 pieces center of chuck, appropriate blocking.

TABLE SPEED: 24 R.P.M.

FEED: .016"/Minute.

DRESSED WHEEL: Once very lightly going through scale.

STOCK REMOVED PER PIECE, CU. IN.: .945" (average).

GRINDING TIME PER PIECE: 51.5 Seconds.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 1.1.

WHEEL WEAR PER PIECE, CU. IN.: .157.

ABRASIVE COST PER PIECE: $.014.

FLOOR-TO-FLOOR TIME PER PIECE: 1.2 Minutes.

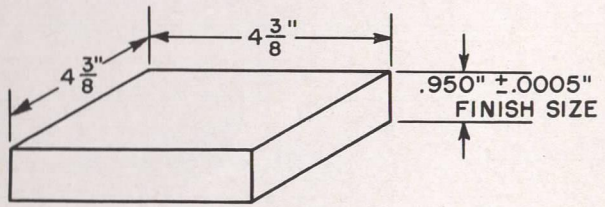
REMARKS: Competitors open structure wheel on this same job drew more power than the 9A30HI8V, required three dressings while going through the scale, yet took 63.7% more time for the same stock removal. This is an example of the savings possible through the selection of the proper Blanchard made wheel for Blanchard grinding.

MATERIAL: Hardened Steel "Winston 150" Rc62, Wear Resistant.

WHEEL: 59A60HI8V — 11" x 5" x 9". Blanchard Cylinder Wheel.

BLANCHARD GRINDER: Standard Blanchard No. 11, 16" Chuck, 15 HP.

THE JOB: Blanchard Grind Two Sides. Flat & Parallel ±.0005". Finish 10 R.M.S. or better. Thickness of pieces at start 1.000".



HOW LOADED: 4 pieces on Chuck, Held Magnetically with appropriate blocking.

TABLE SPEED: 24 R.P.M.

FEED: .016"/Minute.

DRESSED WHEEL: None.

STOCK REMOVED PER PIECE, CU. IN.: .956.

GRINDING TIME PER PIECE: 1.56 Minutes.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: .613.

WHEEL WEAR PER PIECE, CU. IN.: .393.

ABRASIVE COST PER PIECE: $.034.

FLOOR-TO-FLOOR TIME PER PIECE: 2.0 Minutes.

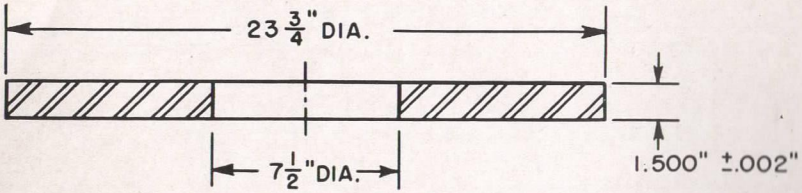
REMARKS: This job is an illustration of proper wheel selection to meet the close tolerances and finish requirements and at the same time keep grinding costs to a minimum. With .050" stock to remove the rate of stock removal is important. This is a good wheel to keep in mind where both good finish and stock removal are requirements. It should be noted that this is a wear resistant steel which is always difficult to grind.

MATERIAL: Silico Manganese Oil Hardening Steel, Rock C53-64 C-.60, Mn-.70, Si-1.85, Mo-.50, Va-.25.

WHEEL: 9A46G8V — 20" x 5" x 16½"K. Blanchard Cylinder Wheel.

BLANCHARD GRINDER: No. 18, 36" Chuck, 35 HP, Extended Head.

THE JOB: Rotary Shears. Finish grind to 1.500 ± .002". Commercial Finish. Flat & Parallel ±.001".



HOW LOADED: Held Magnetically, one at a time, center of chuck.

TABLE SPEED: 18 R.P.M.

FEED: .012"/Minute.

DRESSED WHEEL: None required.

STOCK REMOVED PER PIECE, CU. IN.: 25.1.

GRINDING TIME PER PIECE: 8.33 Minutes.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 3.015.

WHEEL WEAR PER PIECE, CU. IN.: 3.7.

ABRASIVE COST PER PIECE: $.305.

FLOOR-TO-FLOOR TIME PER PIECE: 10 Minutes.

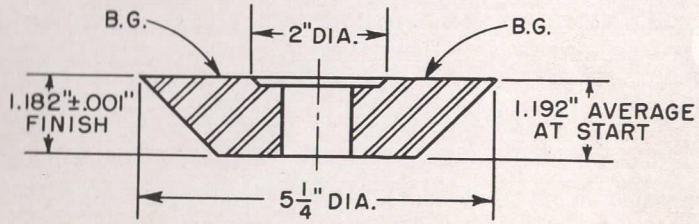
REMARKS: These shear knives are periodically reground. The above results are an average of several knives which were 1.563" at the start of grinding. Maximum power consumed on the above was 125% full load. A good illustration of proper Wheel Selection on a maintenance job.

MATERIAL: #8620-H Forging. Carburized to Rockwell C 57-63.

WHEEL: 9A4618V — 11" x 5" x 9"K. Blanchard Cylinder Wheel.

BLANCHARD GRINDER: Standard No. 11, 16" Chuck, 15 HP Spindle.

THE JOB: Blanchard grind ring gear surface as shown in sketch. One operation, flat & parallel ±.001", finish 20 R.M.S.



HOW LOADED: One piece in center of chuck, held in a fixture.

TABLE SPEED: 64 R.P.M.

FEED: .064"/Minute.

DRESSED WHEEL: None.

STOCK REMOVED PER PIECE, CU. IN.: .185.

GRINDING TIME PER PIECE: 10 Seconds.

RATE OF STOCK REMOVAL, CU. IN. PER MIN.: 1.115.

WHEEL WEAR PER PIECE, CU. IN.: .0196.

ABRASIVE COST PER PIECE: $.0017.

FLOOR-TO-FLOOR TIME PER PIECE: 36 Seconds.

REMARKS: The above wheel gives an average of 6400 pieces of work ground. Competitors' segments on the same job gave only 1000 pieces during their life. Increased feed, possible with the above wheel, gives a time saving as well as six times the production.

III

HOW TO OPERATE BLANCHARD GRINDERS

Production Grinding

All work ground on Blanchard Grinders must be securely held to resist the grinding wheel pressure either by supplementing magnetic holding with blocking or mechanically clamping the pieces. Wherever possible the magnetic chuck is used to hold pieces, loading the work between concentric steel rings. In the case of fairly large pieces the pieces are used to block each other and additional pieces of steel or cast iron used as stops.

To get the most out of the Grinder the operator should study work handling and whenever possible reduce the non-grinding time of the machine. Production can be increased also if the operator will plan the handling of the work so that while the machine is grinding a load of pieces he can be washing, piling on a near bench, and otherwise preparing the next chuck load.

Sometimes loading plates are used which are loaded at the bench. Blocking rings are placed on the loading plate and the pieces placed just as if loading the magnetic chuck. The loading plate with its load of work is then placed on the magnetic chuck, the blocking rings held stationary, and the plate pulled out from under the pieces. The current to the chuck is turned on and the pieces ground in the usual way. Sometimes a helper is used to assist the operator if the grinding cycle is very short.

To increase production of very small pieces when the No. 11 Blanchard is used for grinding, a grease board transfer can be used. In this case the pieces would be placed on a platen or flat bench in an area which would represent the magnetic chuck,

then a disc of wood having a smear of grease on one side would be placed grease side down on top of the pieces. The pieces will stick to the board which would be carried to and placed on the magnetic chuck pieces down, magnetism turned on, and board removed. Blocking rings are of course also used.

Small pieces which do not block each other well can be placed in holes in a non-magnetic plate located on the magnetic chuck. The holes should be cut in the masking plate so as to position the work over the strongest parts of the chuck.

When grinding large plates which cover all or most of the surface of the chuck, production can be increased if the step grinding method is used. The table is positioned under the wheel only part way leaving a center about one half the diameter of the chuck which will not be ground at this setting. After grinding the outer part the wheel is raised and table traversed all the way in and the center part ground matching the cuts and doing the finish grinding at this setting.

Column Adjustments

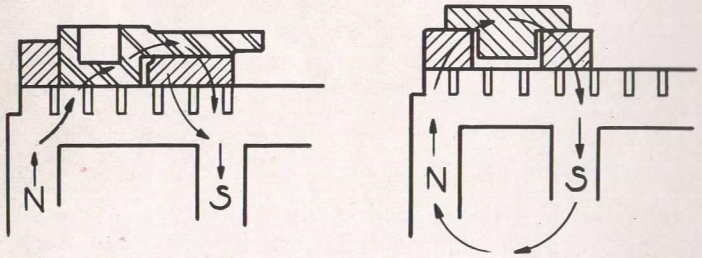
Normally the Grinder head is adjusted through the 3-point column support to show a cross wheel mark when work is finished. To produce this finish the wheel cuts on both sides, the grinding pressure being first toward the center of the chuck; then as the side of the wheel farthest from the operator grinds, the pressure is toward the outside of the chuck. The work must be blocked to resist these pressures coming from opposite directions. However, many times, when grinding small, thin pieces which cannot be blocked as securely as we would like, the column is adjusted so only one side of the wheel grinds. The pressure from grinding is then in one direction only, and after a few revolutions of the chuck the pieces are firmly located against the blocking ring or blocking and will not move for the rest of the grinding operation.

It is very important to remember that stops of some sort

must be used to prevent work from sliding. The magnetism holds pieces down but does not hold them sideways, except by the friction between the piece and the chuck face.

Magnetic Fixtures

Many times a flat ground surface is required on a piece the opposite side of which is irregular and cannot be placed directly on the magnetic chuck. Many of these pieces can be held and blocked by the proper positioning of steel or cast iron blocks or rings to bring magnetism up from the main magnetic poles completing the circuit through the work. We show a simple example of how this is done.



Several types of auxiliary magnetic plates can be made for holding odd-shaped pieces. One type which works very well uses a non-magnetic metal body having steel pins, usually sweat in place, which match with the steel poles of the chuck. The top of these auxiliary plates can be profiled and pockets formed in which pieces can be located and held for grinding.

Grinding Non-Magnetic Metals

Non-magnetic metals such as brass, aluminum, and magnesium, can be held for grinding if the parts are blocked to prevent side movement and shimmed if necessary. Sometimes blocking pieces, having sharp pins projecting from the side, are

used to good advantage, the pins acting as spurs to hold the pieces down, and when used to hold round pieces to keep them from spinning.

Clamping Fixtures

Irregular-shaped pieces which do not lend themselves to magnetic holding or blocking require some sort of a mechanical clamping fixture. Two fixtured jobs are shown under wheel selection examples, and it should be noted that generally the fixtures are fairly simple in design.

Elongated, fragile pieces are generally supported on 3 fixed points, with spring pins at critical points to give additional support. Only light clamping pressure at the fixed support points is required to hold the piece for grinding.

Grinding Non-Metallic Pieces

Blanchard Grinding is not limited to metals. Ceramic, Hard Rubber, Plastic, Graphite, Carbon, Glass, Sapphire, Quartz, Minerals, and Clutch Facings are being ground every day on Blanchards.

Some of these materials—Rubber, Plastics, Carbon, Graphite, Molded Articles like Clutch Facings—are held for grinding the same as non-magnetic metals. Other parts—such as Glass, Ceramic, Sapphire—require different holding methods. Described below is the procedure to follow in preparing Glass, Quartz, Ceramic, and Synthetic Sapphire for grinding, the actual grinding, and the grinding wheels to use.

Pieces of the materials to be ground are mounted on cast iron or steel plates using wax, wax and resin, optical pitch, or shellac as an adhesive. If the pieces are to be flat and parallel, the plates must be flat and parallel and have no better than a fair finish. These should be ground on the Blanchard using a 24 grit wheel for steel plates and no finer than 30 grit for cast iron plates. The plate should be heated and a film of adhesive

melted on the top surface. The glass should be placed on the plate and the plate, glass, and adhesive cooled. The fairly rough finish on the plate allows the adhesive to bleed out from between the glass and plate leaving a very thin film of uniform thickness giving very accurate location of the work. Thin quartz wafers for radio frequency control are held to size within .0002″.

Boro silicon glass is quite soft and is easy to grind; therefore, straight paraffin wax or beeswax is strong enough to hold it to the blocking plate. Flint glass, quartz, and sapphire require a stronger adhesive—such as optical pitch or a mixture of 4 parts yellow beeswax to 1 part cherry bark resin. Very small pieces, such as jewel bearings of sapphire or ruby, are generally held by using melted shellac.

When using the No. 11 Blanchard Grinder, the wheels—either silicon carbide or diamond—should be 10″ in diameter to give best results, and a table speed of 41 RPM is recommended. The No. 18 Grinder should use a 16″ diameter wheel and a table speed of 25 RPM.

After making sure the bottom of the cooled blocking plate is clean, it is placed on the magnetic chuck and the material ground in the usual way. When silicon carbide wheels are used, a down feed of .028″ is usually used when grinding soft glass. The last .005″ should be removed at the lowest rate of down feed if a good finish is required. If a 120M100 diamond wheel is used, down feeds of over .048″ can be used. Diamond wheels are necessary when grinding quartz, natural corundum (agate), hard ceramic, and synthetic sapphire.

To get good finishes using silicon carbide wheels, round the inside and outside edges of the wheel face to about 1/16″ radius, using a dressing stick of silicon carbide held by hand.

When pieces are to be finally polished, a 400B100 wheel is usually used, allowing not more than .003″ stock to be removed

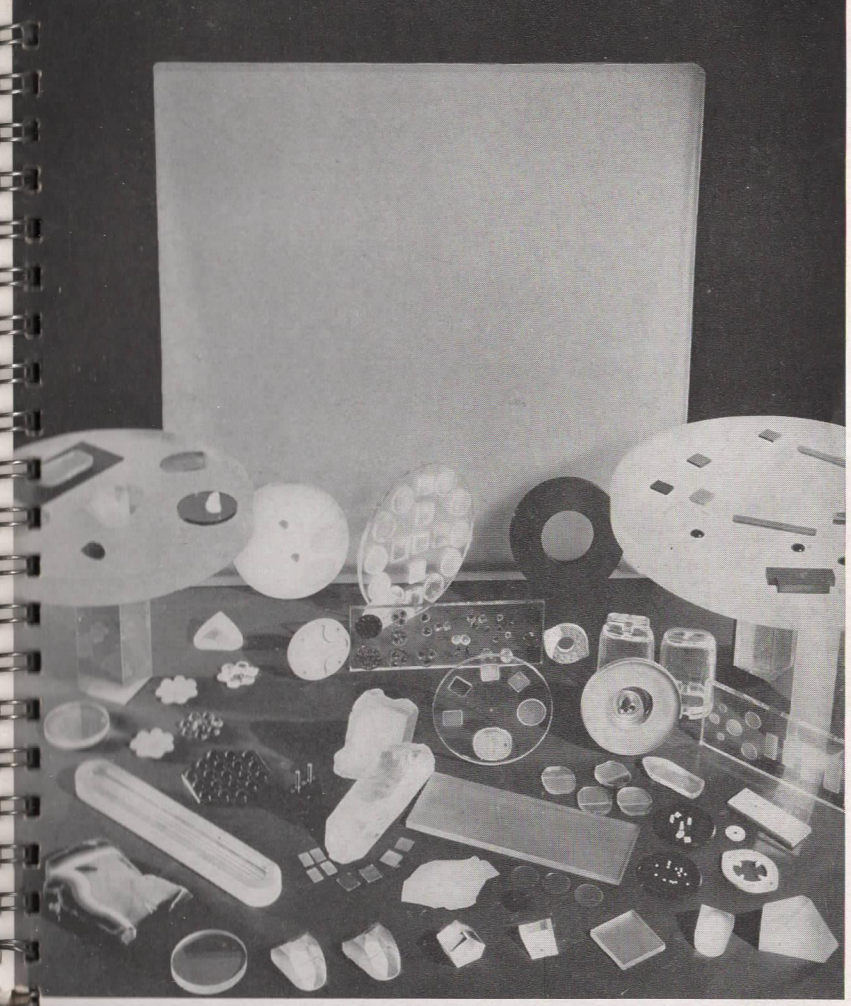


Plate 7

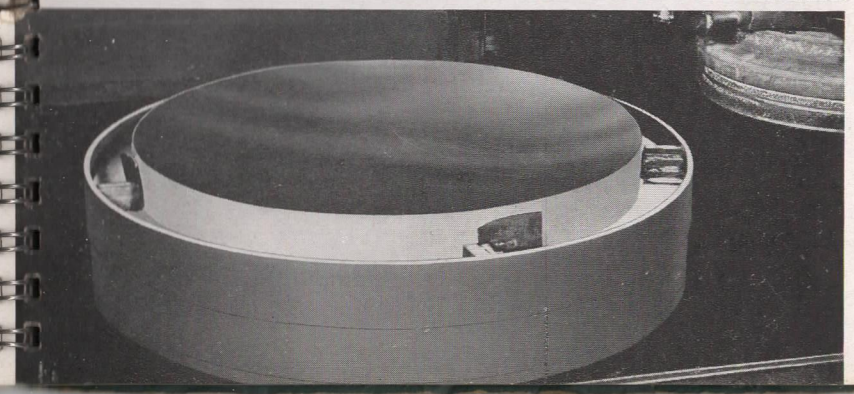


Plate 8

by this wheel. A very slow rate of down feed is used, about .0015″ per minute, feeding being by hand if not specially provided for on the grinder.

Pieces can be removed from the blocking plate after heating the plate enough to melt the adhesive. Wax can be cleaned from pieces using XYLOL acetone, carbon tetrachloride, or any wax solvent. Then the pieces can be set up for grinding the second side. Pieces like prisms or wedges can be ground on the angles by mounting them on the angular surfaces of fixtures. Many No. 11 Blanchard Grinders are used in the optical industry for precision grinding of optical elements. Pyrex blanks 10″ in diameter are ground to within 2 light bands of perfect flatness.

Plates No. 7 and 8 show some of the non-metallic pieces ground on Blanchards.

When diamond wheels are used, whether for glass or tungsten carbide grinding, they require dressing from time to time. This dressing is usually to remove the ground-up matter which has become embedded in the face of the wheel and bares or exposes the diamonds so they can continue to cut.

The most successful method we know of for the dressing operation is to center a fine grain silicon carbide wheel mounted in its ring on the magnetic chuck face-up. Then with *magnetism on*, position the wheel under the diamond wheel, which is mounted on spindle, so that the wheels just lap each other. Then rotate the magnetic chuck at 64 RPM and feed the diamond wheel down until it touches the silicon carbide wheel. *Do not use power on the wheel spindle.* Start the diamond wheel rotating by hand, feeding down at the same time. The silicon carbide wheel will rub hard enough on the face of the diamond wheel to keep it rotating and at the same time will clean or dress the wheel. Grinding compound should be used to cool and lubricate the wheels.

Use a 100 grit silicon carbide wheel for dressing wheels up to 320 grit, and 220 grit silicon carbide wheel for dressing wheels finer than 320 grit size.

Convex and Concave Grinding

It is sometimes desired to grind a piece so that it will be thicker on the outer edge. This is the case in grinding certain types of saws. The three-point column support makes it possible to grind spherical surfaces by raising or lowering the rear point. When grinders are purchased primarily for this type of grinding they are often equipped with a Quick-Tilting Device which permits rapid adjustments of the rear point. The following equation will give the amount to raise the rear column support point to give a specific difference in thickness between the edge and center of a single disc chucked centrally:

$$R = \frac{4hWC}{d^2}, \quad \text{where}$$

R = Amount to raise rear column support point.
h = Difference in thickness between the outer edge and center, or amount of dishing desired.
W = Diameter of wheel used*.
C = Perpendicular distance from the center of the rear column support to line joining the center points of the other two supports.
d = Diameter of piece being ground.

The value of C for various Blanchard grinders is as follows: No. 10—15″, No. 11—17″, No. 16—17¼″, No. 18—23¼″.

Finish

Good finishes can be obtained with medium grain wheels by the following procedure. When final size is approached, con-

*For accurate results the value of W used should be the diameter of the center line of the surface of the wheel in contact with the work. This will be somewhat less than the diameter of the wheel.

tinue grinding for several turns of the chuck without down feed of the grinding wheel. This is sometimes referred to as "sparking out." Raise the wheel by hand from .001″ to .002″ very slowly. This procedure will give a finish of from 15 to 20 micro-inches on hardened steel when a 24 grit wheel is used, or on soft steel when a 46 grit wheel is used.

The same procedure should be followed when using fine grit wheels for fine finishes. It is absolutely essential to use a free cutting wheel, since wheels as fine as 220 grit size are quite dense and a wheel too hard for the job will tend to heat the work and will not produce the accuracy possible with the freer-cutting wheel. In using fine grit wheels, 100 grit or finer, the regular wheel dresser can be used occasionally if it is necessary, but only light pressure should be used for this operation. To give best results a silicon carbide dressing stick should be used, holding the stick against the face of the wheel as the wheel idles down to a stop. The inside and outside corners of the wheel should be rounded to about 1/16″ radius in order to obtain the best finishes possible and eliminate occasional scratches.

When grinding large steel plates which have to be accurately flat and parallel, it is good practice to raise the wheel just before size is reached, dress it, then feed the wheel down to the work by hand, removing .001″ to .002″ stock from the plate, leaving a finish which shows the cross wheel marks over the entire surface of the plate. The cross wheel marks will indicate that there are no low spots in the surface of the plate, and if the magnetic chuck has been ground flat, the sides should be parallel after both sides have been ground in this manner. If a large plate is ground in a location which is off center on the magnetic chuck, the above procedure should be used; and, in addition, if the plate is of hardened steel or a hard tough alloy, we recommend coppering two diagonal lines on the plate, connecting the extreme corners, then dressing the wheel and grinding the surface lightly until the copper is removed from the

entire surface when the wheel just barely touches the work. Copper sulphate crystals dissolved in water with one or two drops of any acid makes a good solution to use.

When using wheels 46 grain size or coarser, down feeds of from .012″ to .064″ per minute are used, depending on the material being ground and the area of the surface. Coarser grit wheels for softer material will allow the more rapid rates of down feed but when finer grit wheels are used the rate of down feed should be reduced. Table speeds of 12 to 25 RPM on the No. 18 Grinder, and 15 and 24 RPM on the No. 11 Grinder are recommended when coarse-grit wheels are used. To improve the finish when using coarse-grit wheels, the final finishing can be done using the slowest table speed. However, when fine-grit wheels are used the highest table speed is recommended as the high speed allows the work to pass under the fine grit wheel fast enough to eliminate danger of overheating.

Extreme Accuracy of Size, Parallelism, Flatness and Finish

When work is to be ground which requires extreme accuracy for size, parallelism, flatness and finish, the following procedure is usually followed:

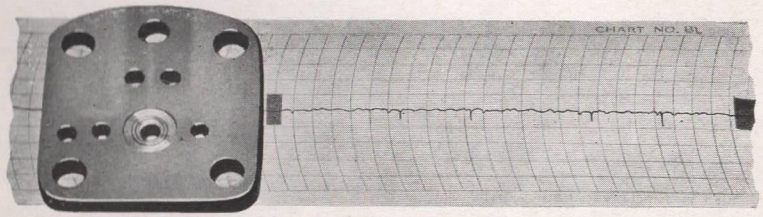


Plate 9

Blanchard-ground surface of Valve Plate as recorded by the Brush Surface Analyzer (attenuator set at .01). Chart shows maximum surface roughness value of 3 to 4 microinches. Blanchard Wheel C150GB used to obtain this finish.

BLANCHARD

BLANCHARD PRODUCTS

No. 11 High Power Surface Grinder
No. 18 High Power Surface Grinder
No. 18-C High Power Surface Grinder
No. 32-48 High Power Surface Grinder
No. 36-60 High Power Surface Grinder
No. 42-72 High Power Surface Grinder
No. 42-72-84 High Power Surface Grinder
No. 16-A Automatic Surface Grinder
No. 16-A2 Automatic Surface Grinder
No. 16-A Dual Automatic Surface Grinder
No. 22-A Series Automatic Surface Grinders (3 to 5 Spindles)
No. 80-A-3 Series Automatic Surface Grinder
No. 90-A-4 Series Automatic Surface Grinder
No. 100-A-5 Series Automatic Surface Grinder
Cylinder, Sectored and Segment Wheels for Blanchard Surface Grinders
Cylinder Wheel Holders

Demagnetizers	Wheel Mounter
Washing Attachment	Caliper Attachment

Mechanical or Magnetic Fixtures for Blanchard Grinders

THE BLANCHARD MACHINE COMPANY
64 State Street
Cambridge 39, Massachusetts, U.S.A.

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